

How to structure quantitative research questions¹

There is no "one best way" to structure a quantitative research question. However, to create a well-structured quantitative research question, we recommend an approach that is based on **four steps**:

- (1) Choosing the type of quantitative research question you are trying to create (i.e., descriptive, comparative or relationship-based);
- (2) Identifying the different types of variables you are trying to measure, manipulate and/or control, as well as any groups you may be interested in;
- (3) Selecting the appropriate structure for the chosen type of quantitative research question, based on the variables and/or groups involved; and
- (4) Writing out the problem or issues you are trying to address in the form of a complete research question.

In this article, we discuss each of these **four steps**, as well as providing examples for the three types of quantitative research question you may want to create: **descriptive**, **comparative** and **relationship-based research questions**.

STEP ONE

Choose the type of quantitative research question (i.e., descriptive, comparative or relationship) you are trying to create

The **type** of quantitative research question that you use in your dissertation (i.e., **descriptive**, **comparative** and/or **relationship-based**) needs to be reflected in the way that you write out the research question; that is, the word choice and phrasing that you use when constructing a research question tells the reader whether it is a descriptive, comparative or relationship-based research question. Therefore, in order to know how to structure your quantitative research question, you need to start by selecting the type of quantitative research question you are trying to create: descriptive, comparative and/or relationship-based.

STEP TWO

Identify the different types of variable you are trying to measure, manipulate and/or control, as well as any groups you may be interested in

Whether you are trying to create a descriptive, comparative or relationship-based research question, you will need to identify the different types of variable that you are trying to

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measure, manipulate and/or **control**. If you are unfamiliar with the different types of variable that may be part of your study, the article, [Types of variable](#), should get you up to speed. It explains the two main types of variables: **categorical variables** (i.e., **nominal, dichotomous** and **ordinal** variables) and **continuous variables** (i.e., **interval** and **ratio** variables). It also explains the difference between **independent** and **dependent variables**, which you need to understand to create quantitative research questions.

To provide a brief explanation; a **variable** is not only something that you **measure**, but also something that you can **manipulate** and **control** for. In most undergraduate and master's level dissertations, you are only likely to **measure** and **manipulate** variables. You are unlikely to carry out research that requires you to **control** for variables, although some supervisors will expect this additional level of complexity. If you plan to only create **descriptive research questions**, you may simply have a number of **dependent variables** that you need to measure. However, where you plan to create **comparative** and/or **relationship-based research questions**, you will deal with both **dependent** and **independent variables**. An **independent variable** (sometimes called an **experimental** or **predictor variable**) is a variable that is being **manipulated** in an experiment in order to observe the effect this has on a **dependent variable** (sometimes called an **outcome variable**). For example, if we were interested in investigating **the relationship between enzymes and cellulose degradation**, the independent variable would be **enzymes** and the dependent variable **cellulose degradation**. This example also highlights the need to identify the **group(s)** you are interested in. In this example, the group of interest are **cellulosic wastes-feedstocks (like soy bean seeds)**.

Once you identifying the different types of variable you are trying to measure, manipulate and/or control, as well as any groups you may be interested in, it is possible to start thinking about the way that the three types of quantitative research question can be **structured**. This is discussed next.

STEP THREE

Select the appropriate structure for the chosen type of quantitative research question, based on the variables and/or groups involved

The **structure** of the three types of quantitative research question differs, reflecting the goals of the question, the types of variables, and the number of variables and groups involved. By **structure**, we mean the **components** of a research question (i.e., the types of variables, groups of interest), the **number** of these different components (i.e., how many variables and groups are being investigated), and the **order** that these should be presented (e.g., independent variables before dependent variables). The appropriate structure for each of these quantitative research questions is set out below:

[Structure of descriptive research questions](#)

There are **five steps** required to construct a descriptive research question:

1. Choose your starting phrase

2. Identify and name the dependent variable
3. Identify the group(s) you are interested in
4. Include any words that provide greater context to your question
5. Write out the descriptive research question

Each of these steps is discussed in turn:

FIRST

Choose your starting phrase

You can start descriptive research questions with any of the following phrases:

How much?
 What percentage?
 What proportion?
 What is?
 What are?

Some of these starting phrases are highlighted in **blue text** in the examples below:

What are the factors that influence the *cellulose degradation of soy bean seeds in Colombia?*

What proportion of *Chlorella microalgae produce lipids and sugar for ethanol technology?*

What percentage of *cell debris remotion could be obtained on a microfiltration process?*

What is the alternative to improve biofuel production from palm oil in Biodiesel Associative Ltd.?

SECOND

Identify and name the dependent variable

All descriptive research questions have a dependent variable. You need to identify what this is. However, how the dependent variable is written out in a research question and what you call it are often two different things. In the examples below, we have illustrated the name of the dependent variable and highlighted how it would be written out in the **blue text**.

Name of the dependent variable	How the dependent variable is written out
Cell debris remotion	What percentage of cell debris remotion could be obtained on a microfiltration process?
cellulose degradation	What are the factors that influence the cellulose

degradation of oil palm seeds in Colombia?

Lipids and sugar production

What proportion of *Chlorella microalgae* produce *lipids and sugar* for ethanol technology?

Biofuel production

What is the alternative to improve *biofuel production* from palm oil in Biodiesel Associative Ltd.?

THIRD

Identify the group(s) you are interested in

All descriptive research questions have at least *one group*, but can have *multiple groups*. You need to identify this group(s). In the examples below, we have identified the *group(s)* in the *green text*.

What are *the factors that influence the cellulose degradation of oil palm seeds in Colombia?*

What proportion of *Chlorella microalgae* produce lipids and sugar for ethanol technology?

What percentage of *cell debris removal could be obtained on a microfiltration process?*

What is the alternative to improve biofuel production from palm oil in *Biodiesel Associative Ltd.?*

FOURTH

Include any words that provide greater context to your question

Sometimes the name of the dependent variable provides all the explanation we need to know what we are trying to measure. Take the following examples:

What are *the factors that influence the cellulose degradation of soy bean seeds in Colombia?*

What proportion of *Chlorella microalgae* produce lipids and sugar for ethanol technology?

In the first example, the dependent variable is cellulose degradation (i.e., biological oxygen demand BOD per organic waste intake consumed per day). Clearly, this descriptive research question is asking us to measure the BOD reduced affected by enzyme degradation of soy bean seeds. In the second example, the dependent variable is lipids and sugar amount. Again, the name of this dependent variable makes it easy for us to understand that we are trying to measure the percentage (e.g., 16 percent) *Chlorella microalgae* produce lipids and sugar.

However, sometimes a descriptive research question is not simply interested in *measuring* the dependent variable in its entirety, but a particular *component* of the dependent variable. Take the following examples in *red text*:

What are *the factors that influence total cellulose degradation of soy bean seeds in Colombia?*

What proportion of Chlorella microalgae produce *an excess of* lipids and sugar for ethanol technology?

In the first example, the research question is not simply interested in the cellulose degradation, but how complete is the degradation. So the dependent variable is still cellulose degradation, but the research question aims to understand a particular component of that dependent variable (i.e., the percentage of cellulose degradation).

Therefore, when you think about constructing your descriptive research question, make sure you have included any words that provide greater context to your question.

FIFTH

Write out the descriptive research question

Once you have these details ? **(1)** the starting phrase, **(2)** the name of the dependent variable, **(3)** the name of the group(s) you are interested in, and **(4)** any potential joining words ? you can write out the descriptive research question in full. The example descriptive research questions discussed above are written out in full below:

What are *the factors that influence total cellulose degradation of soy bean seeds in Colombia?*

In the section that follows, the [structure of comparative research questions](#) is discussed.

Structure of comparative research questions

There are **five steps** required to construct a comparative research question: **(1)** choose your starting phrase; **(2)** identify and name the dependent variable; **(3)** identify the groups you are interested in; **(4)** identify the appropriate adjoining text; and **(5)** write out the comparative research question. Each of these steps is discussed in turn:

1. Choose your starting phrase
2. Identify and name the dependent variable
3. Identify the groups you are interested in
4. Identify the appropriate adjoining text
5. Write out the comparative research question

FIRST

Choose your starting phrase

Comparative research questions typically start with one of two phrases:

Number of dependent variables	Starting phrase
<hr/>	

Two

What is the difference in?

Three or more

What are the differences in?

Some of these *starting phrases* are highlighted in **blue text** in the examples below:

What is the difference in the *cellulose degradation at high and low temperatures of soy bean seeds in Colombia?*

Wha is the differece in *lipids and sugar yield of Chlorella microalgae changing atmospherical conditions ?*

SECOND

Identify and name the dependent variable

All comparative research questions have a *dependent variable*. You need to identify what this is. However, how the dependent variable is written out in a research question and what you call it are often two different things. In the examples below, we have illustrated the *name* of the **dependent variable** and highlighted how it would be *written out* in the **blue text**.

Name of the dependent variable

How the dependent variable is written out

Cellulose degradation

What is the difference in the **cellulose degradation** at high and low temperatures of soy bean seeds in Colombia?

lipids and sugar yield

Wha is the differece in **lipids and sugar yield** of *Chlorella microalgae changing atmospherical conditions ?*

THIRD

Identify the groups you are interested in

All comparative research questions have at least *two groups*. You need to identify these groups. In the examples below, we have identified the **groups** in the **green text**.

What is the difference in the *cellulose degradation* **at high and low temperatures of soy bean seeds in Colombia?**

Wha is the differece in *lipids and sugar yield* **of Chlorella microalgae changing atmospherical conditions ?**

It is often easy to identify groups because they reflect different types of objects (e.g., temperatures, atmospherical conditions), as highlighted by the examples. However, sometimes the two groups you are interested in reflect two different conditions.

FOURTH

Identify the appropriate adjoining text

Before you write out the groups you are interested in comparing, you typically need to include some adjoining text. Typically, this adjoining text includes the words *between* or *amongst*, but other words may be more appropriate, as highlighted by the examples in **red text** below:

What is the difference in the *cellulose degradation* **at** high and low temperatures of soy bean seeds in Colombia?

What is the difference in *lipids and sugar yield of Chlorella microalgae* **amongst** different atmospheric conditions ?

FIFTH

Write out the comparative research question

Once you have these details - **(1)** the starting phrase, **(2)** the name of the dependent variable, **(3)** the name of the groups you are interested in comparing, and **(4)** any potential adjoining words - you can write out the comparative research question in full. The example comparative research questions discussed above are written out in full below:

What is the difference in the *cellulose degradation* at high and low temperatures of soy bean seeds in Colombia?

What is the difference in *lipids and sugar yield of Chlorella microalgae* amongst different atmospheric conditions ?

In the section that follows, the [structure of relationship-based research questions](#) is discussed.

Structure of relationship-based research questions

There are **six steps** required to construct a relationship-based research question: **(1)** choose your starting phrase; **(2)** identify the independent variable(s); **(3)** identify the dependent variable(s); **(4)** identify the group(s); **(5)** identify the appropriate adjoining text; and **(6)** write out the relationship-based research question. Each of these steps is discussed in turn.

1. Choose your starting phrase
2. Identify the independent variable(s)
3. Identify the dependent variable(s)
4. Identify the group(s)
5. Identify the appropriate adjoining text
6. Write out the relationship-based research question

FIRST

Choose your starting phrase

Relationship-based research questions typically start with one or two phrases:

Name of the independent variable	Starting phrase
Two	What is the relationship between? (social)
Three or more	What are the relationships of?

This *starting phrase* is highlighted in **blue text** in the example below:

What is the relationship of temperature and atmospherical conditions on lipids yield amongst Chlorella microalgae?

SECOND

Name the independent variable(s)

All relationship-based research questions have at least one *independent variable*. You need to identify what this is. In the example that follow, the **independent variable(s)** is highlighted in the **purple text**.

What is the relationship of **temperature and atmospherical conditions** on lipids yield amongst Chlorella microalgae?

When doing a dissertation at the undergraduate and master's level, it is likely that your research question will only have one or two independent variables, but this is not always the case.

THIRD

Name the dependent variable(s)

All relationship-based research questions also have at least one *dependent variable*. You also need to identify what this is. At the undergraduate and master's level, it is likely that your research question will only have one dependent variable. In the example that follow, the **dependent variable** is highlighted in the **blue text**.

What is the relationship of temperature and atmospherical conditions on **lipids yield** amongst Chlorella microalgae?

FOURTH

Name of the group(s)

All relationship-based research questions have at least *one group*, but can have *multiple groups*. You need to identify this group(s). In the example below, we have identified the group(s) in the **green text**.

What is the relationship of temperature and atmospherical conditions on lipids yield amongst **Chlorella microalgae**?

FIFTH

Identify the appropriate adjoining text

Before you write out the groups you are interested in comparing, you typically need to include some adjoining text (i.e., usually the words between or amongst):

Number of groups	Adjoining text
One	amongst? [e.g., group 1]
Two or more	between? of? [e.g., group 1 and group 2]

This is highlighted in **red text** below:

What is the relationship of temperature and atmospherical conditions on lipids yield **amongst** Chlorella microalgae?

SIXTH

Write out the relationship-based research question

Once you have these details ? **(1)** the starting phrase, **(2)** the name of the dependent variable, **(3)** the name of the independent variable, **(4)** the name of the group(s) you are interested in, and **(5)** any potential adjoining words ? you can write out the relationship-based research question in full. The example relationship-based research questions discussed above are written out in full below:

What is the relationship of temperature and atmospherical conditions on lipids yield amongst Chlorella microalgae?

STEP FOUR

Write out the problem or issues you are trying to address in the form of a complete research question

In the previous section, we illustrated how to write out the three types of research question (i.e., descriptive, comparative and relationship-based research questions). Whilst these rules should help you when writing out your research question(s), the main thing you should keep in mind is whether your research question(s) **flow** and are **easy to read**.

PRE TEST

Please select	True (T) or False (F)
Research questions and research hypotheses are the same thing.	
Research questions should “foreshadow” the data analyses.	
Research questions should be posed after data are collected.	
Research questions should be written using non-specific language to allow flexibility in designing the study.	
All of the following are types of variables that might be included in research questions: dependent, extraneous, independent, categorical, continuous	
Writing quantitative research questions requires knowledge of statistics.	
Components of a research question are variables, groups of interest	
Descriptive research, is used to describe characteristics of a population or phenomenon being studied	
The starting phrase of a comparative research question can be “What is the relationship between..?”	